Dear editor：

Please find enclosed our revised manuscript, entitled “Impacts of freezing and thawing dynamics on foliar litter carbon release in alpine/subalpine forests along an altitudinal gradient in the eastern Tibetan Plateau" (Manuscript number: bg-2014-258)”, (by Wu et al.) for consideration for publication in the Special Issue: 9th International Carbon Dioxide Conference (ICDC9) (ESD/ACP/BG/AMT Inter-Journal SI) in Biogeosciences.

First of all, we would like to express our great appreciation to you and anonymous reviewers for valuable suggestions and comments on the previous version of the manuscript. The revised manuscript has been improved as a result of their constructive advice. Our responses to the reviewers’ comments and modifications are detailed in following pages.

We hope that the revised manuscript is satisfactory to your journal. Please feel free to contact me if further information is required. Thank you very much for your consideration. I am looking forward to hearing from you soon.

Sincerely yours,

Fuzhong Wu et al.

Responses to Reviewers

Anonymous Referee #1

This paper presents the effect of temperature on the decomposition (or C loss) of three foliar litters at 4 locations varying in altitude and temperature (and other features) in the eastern Tibetan Plateau over a two-year period. It was found that the overall C release rate was slightly faster in the higher elevation sites and the seasonal rates varied among the litter types

and the sites. It was speculated that warmer temperatures may slow down the rate of litter decomposition in this environment. This experiment was well-designed and the findings were interesting. However, there are some areas for the manuscript to be improved. The discussion and conclusions should be much clearer, based on the objectives to examine the effects of freezing and thawing on the litter decomposition and to determine how the effects vary with altitude or dominant tree species. Some revisions are necessary before it can be considered for publication.

RE: We thank you for your positive feedback and valuable suggestions! We strengthened the discussion and conclusion based on how the effects vary with altitude or dominant tree species in the revised edition as you suggested.

Specific comments:

Title can be changed to be "Impacts of freezing and thawing dynamics on foliar litter carbon release in alpine/subalpine forests along an altitudinal gradient in the eastern Tibetan Plateau".

RE: We are very grateful for your valuable comments. We agreed to change the title in the revised edition.

Line 1 : Carbon (C) release includes two processes, one is respiration by microbial activities, and another one is C leaching. Thus, the first sentence emphasized the importance of C flux results from respiration, but neglected the leaching, in particular at early stage of decomposition.

RE: Good question! We changed the sentence to "Carbon (C) release from foliar litter is a primary component in C exchange among the atmosphere, vegetation, soil and water from respiration and leaching".

Line 9: "but higher altitudes exhibited" : : :: : :. Change to "but high altitudes exhibited high C release".

RE: Done as you suggested, thanks.

Line 14-15: the conclusions should be more directly from your study.

RE: Thank you for your nice suggestions. We changed the conclusion to "The results suggested that the changed freezing and thawing dynamics could delay the onset of C release in fresh litter in this cold region in the scenario of climate warming."

Line 114 -115: the temperature is not a fixed value and should be a range, because there are four sites at different altitudes.

RE: We are very grateful for your valuable comments. The temperature and other climate characters described in Line 114-118 are the annual average climate in the study area. In order to get the differences of temperature dynamics in four sampling forests with different altitudes, temperatures in litterbags were measured every two hours between 6 November, 2008, and 16 November, 2010 (Fig. 2) in each sampling forest with different altitudes, using a DS1923-F5 iButtony logger (Maxim Integrated Products, Inc., San Gabriel Drive Sunnyvale,

USA).

Line 140-143: Litter of each tree species was placed in their own litter bag separately, or together in a bag?

RE: Thank you for your nice comments. Litter of each tree species was placed in their own litter bag separately. We have revised the unclear description to avoid misunderstanding.

Line 182-184: why not use "*k*"?

RE: Good question! The normal decomposition rate "*k*" often represents long time decomposition at least one year or more. This study mainly focused on the decomposition rate in each freezing-thawing stage, where some stages had only less than 30 days. So that, we believe that "C release rates per day (Vc)" should be clearer in describing the effects of freezing-thawing on C release than "*k*".

Line 305: Do you want to say the different among tree species? If yes, please use initial litter chemistry to reinforce your conclusions.

RE: Thank you for your nice comments. The present paragraph mainly analysis the effects of temperature and freezing-thawing in each decomposition stage, and we found temperature did more effects in winter than that in growing season. The finding was consistent with the previous opinion that freeze-thaw and litter chemical properties control winter litter decomposition but microbe-related factors control growing season (Zhu et al. 2013). We have analyzed the differences among tree species in the follow paragraph in detail. We have revised the confused description.

Line 346: What did your study agree with?

RE: Thank you for your nice comments. Here, the results agree with that "N can be an important factor in controlling C release in this ecosystem as many other studies have reported". We have revised the confused description.

Line 385-387: please point out that the higher C release rate was the results of two year observation.

RE: Done as you suggested, thanks.

Table 1: please use variance analysis to determine the difference among tree species.

RE: Done as you suggested, thanks.

Anonymous Referee #2

This paper describes the loss of carbon from the litter from 3 species of trees along a 900 m elevation gradient in Tibet over a two year period. The manuscript adds some interesting new data on leaf decomposition in more extreme environments like the one under discussion.

Furthermore the use of the elevation study allows some interpretation of the effects of a warming climate on litter decomposition. While the paper will undoubtedly be published I do have a number of concerns with the study: Firstly, in the abstract the authors state that "climate warming would delay the onset of C release in fresh litter in this cold region". This is based on the observation that C release in the deep frozen time periods is positively correlated with negative-degree days. This conclusion is both counter-intuitive and not backed up by the data presented in the paper. Loss of C from the leaf material will be caused by a combination of abiotic reactions (principally leaching) and biotic reactions (microbial degradation). In temperate systems, the rate of leaching is almost invariably positively correlated with temperature. Similarly, biotic degradation of leaf litter increases with temperature; at least up to the temperature threshold of the organisms responsible.

RE: We thank you for your positive feedback and valuable suggestions! Yes, we concluded that "climate warming would delay the onset of C release in fresh litter in this cold region". The conclusion was based on "more rapid C release from fresh foliar litter at upper elevations compared to lower elevations in the alpine/subalpine region" because of higher temperature in lower elevations, not just "C release in the deep frozen time periods is positively correlated with negative-degree days". We believe the followed reason might be related to the observation as we analyzed in the discussion section. So-called climate warming is often known as air temperature increasing. In high frigid region with seasonal freezing-thawing and snow coverage, the temperature in soil surface can not keep line with air temperature since warming air can reduce snow thickness. Therefore, we found that "high C release was observed in low altitudes during winter stages, but high altitudes exhibited high C release during growing season stages." We think the results may be attributed to lower soil temperature, stronger freezing, more frequent freeze-thaw cycle in winter in lower altitudes, but more decomposable litter in growing season in higher altitudes. We have strengthened the discussion to avoid misunderstanding.

The author's data show that for most systems studied, the greatest rate of loss of C (on a per day basis- Figure 4) were immediately following litter fall (OF1)and in the early growing season(EG1) both in the first year. Only Fir had rates of C loss in the deep frozen stage in the first year (DF1) similar to rates observed following litter fall or in the early growing season. On a per season basis again with the exception of Fir, the greatest loss of carbon is in the early growing season in the first year (which also corresponds to periods of warmer weather). I believe that the study would benefit from a more formal (statistical) analysis of variance within and between the treatments.

RE: Thank you very much for your nice comments! As you mentioned, only fir had relative higher release rates in DF1 similar with OF1 and EG1 in the first decomposition year, but DF2 showed higher release rates in the second decomposition year. We think the closely explanation was litter quality, especially lignin content which could explain 68% variations among three species (Table 3). Furthermore, to check how much variance in C release could be predicted from altitude, species and their combined interaction, *Rc* and *Vc* were analyzed at

different stages using the univariate process of general linear model (GLM) with altitude, species and their combined interaction as treatments (Table 2). We have strengthened the discussion in the fourth paragraph in the Discussion section.

Secondly, I had difficulty in understanding how the authors calculated the different degree days. This part of the study could be reworded for clarity.

RE: Thank you very much for your nice comments! Temperatures in litterbags were measured every two hours between 6 November, 2008, and 16 November, 2010 (Fig. 2) in each sampling forest with different altitudes, using a DS1923-F5 iButtony logger. Since there are significant freezing-thawing differences between daytime and nighttime from our field observations, daily-pd and daily-nd were calculated from daily average temperatures, day-pd and day-nd were calculated from daytime average temperatures, and night-pd and night-nd were calculated from nighttime average temperatures. 0°C was considered to be the normal threshold.

On more specific issues C as calculated is not necessarily a rate per se (change per unit time) because of the variability in the length of the various stages.

RE: Thank you very much for your nice comments! We mainly aimed to two objectives in this study. One was how much C release from foliar litter in different freezing-thawing stages relative to initial C storage (*Rc*, Fig 3), and the other was how rapid C release in different freezing-thawing stages (*Vc*, Fig 4) to avoid the effects of variability in the length of the various stages. So that, we think both indicators are necessary.

While the thawing period is noted as TP in the figures, it is annotated as TS (Thawing stage) in the introduction There are also a number of minor typographical errors (e.g. page 9541 line 20 should be ‘repeated’ not ‘replicated’

RE: We are very grateful to your nice suggestions! We have carefully checked the minor errors. We hope the revised edition can meet the qualification of Biogeosciences.

Thank you once more!